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THE SUN'S VELOCITY IN SPACE.

BY W. H. S. MONCK.

A mode of estimating the Sun's velocity in space relative to other stars, and thereby estimating its absolute velocity if that of the other stars can be obtained, has occurred to me which I think worth mentioning. I apply it only to the Sun's motion in Declination. That in Right Ascension could be computed on the same principle, but the computation would be somewhat more laborious, besides which I apprehend that as regards this motion there are some disturbing influences. The North Pole is situated in rather an unconspicuous quarter of the sky, and there is no great constellation within a moderate distance of it which might be expected to affect the motion of a large number of stars; therefore I think the average velocity of the stars measured in the direction of the North Pole is about the average velocity for a point selected at random in the sky. The Sun in like manner does not seem to be situated in a part of the sky to or from which stars may be expected to move with unusual velocity. The average velocity of the stars to or from the Sun is not likely to differ much from the average velocity towards a point selected at random in the sky or towards the North Pole, for the reasons already stated. Hence, if we can compare the Sun's velocity in the direction of the North Pole with the average motion of the stars (whether approaching or receding) in that direction, and also ascertain the average velocity of the stars in the line of sight, we may be able to estimate the actual velocity of the Sun's motion towards the North Pole in miles per second.

It is only the stars with considerable proper motion whose proper motions have been ascertained with accuracy or in whose

case we possess anything like a complete list of stars having a motion to or from the North Pole exceeding a definite limit. But if we take, suppose, the one hundred stars having greatest proper motion towards the North Pole and the one hundred stars having greatest proper motion away from it, may we not conclude that the difference between the observed proper motions is due to the motion of the Sun in this direction—the effects of this motion being additive in case of one set of one hundred stars and subtractive in that of the other? This is the principle which I mean to employ. In M. BOSSERT'S catalogue, which I think is the largest catalogue of stars with considerable proper motion that I have met with, I found three hundred and twenty-two stars whose annual motion towards the North Pole is not less than 0″.10. Possibly this list is incomplete at the lower end, as all catalogues are apt to be; but from the number of stars contained in it which have a proper motion in declination of + 0″.10, I think the omission cannot be very numerous. I then took from the same catalogue the three hundred and twenty-two stars which had the greatest proper motion away from the North Pole, and it is on the comparison of these two lists of three hundred and twenty-two stars that I propose to base my estimate of the Sun's velocity in that direction compared with that of an average star. I may, however, remark at the outset that the stars with which I am dealing are not average stars; they are selected on account of their large proper motion. Now, large proper motion may arise from the nearness of the star or from its motion being very nearly perpendicular to the line of sight; but it may also arise—and no doubt in some instances does so—from the star being moving through space with more than the average absolute motion. In this latter case, of course, the effect of the Sun's motion on that of the star will be proportionally less than if it had been moving with the average velocity. If its absolute motion in this direction be double the average velocity, the Sun's motion will only produce half the average proportional effect on it. With this preface I give the results for every tenth star in each series down to the one hundred and sixtieth, and for every twentieth star down to the three hundred and twentieth, beyond which point the catalogue in question does not enable me to proceed.

MOTION IN NORTH POLE DIRECTION.

No. of Star.	Receding.	Approaching.	No. of Star.	Receding.	Approaching.
10....	1".98	0".95	130....	0".48	0".23
20....	1 .35	0 .76	140....	0 .46	0 .22
30....	1 .18	0 .61	150....	0 .44	0 .21
40....	1 .05	0 .45	160....	0 .43	0 .20
50....	0 .88	0 .39	180....	0 .40	0 .18
60....	0 .80	0 .36	200....	0 .39	0 .16
70....	0 .73	0 .34	220....	0 .37	0 .15
80....	0 .67	0 .30	240....	0 .35	0 .13
90....	0 .61	0 .29	260....	0 .34	0 .12
100....	0 .56	0 .26	280....	0 .33	0 .11
110....	0 .53	0 .25	300....	0 .31	0 .10
120....	0 .50	0 .24	320....	0 .31	0 .10

In the early part of this table the proportion is a little over 2 to 1 (in two instances being slightly under that figure), and it is not until reaching about the two-hundredth star of each series that it gets up to 2½ to 1, from which it continues to rise until it stands at a little over 3 to 1 at the end of the table, where the rise is apparently still in progress. I have already suggested two possible explanations of this fact: First, that the stars in the earlier part of the list (in both series) have on the average greater absolute proper motions, and that the effect of the Sun's motion on them is therefore proportionally less; and, secondly, that M. BOSSERT'S catalogue, which I am using, is more deficient in its list of stars having proper motions of between 0".10 and 0".15 in North Pole direction, than in stars having proper motions of between 0".30 and 0".40. Both causes probably contribute to the result; but, bearing in mind that the increase of the ratio is evidently still in progress where my list terminates, I think that with a longer and more complete list of stars the proportion would not be likely to prove less than 3 to 1. A proportion of 2 to 1. it is hardly necessary to state, indicates that the Sun's motion in North Pole direction is one third of the average velocity of the stars resolved in that direction; while a ratio of 3 to 1 implies that the Sun's velocity in that direction is just one half of the average. The Sun is consequently either a slow-moving star or its motion is directed to a point

whose northerly declination falls considerably short of 45°. If we take the average velocity of the stars resolved in this direction (or in any direction assumed at random) to be ten miles per second, the Sun's velocity resolved in the direction of the North Pole will be five miles per second. But I suspect that the general average of star-velocity resolved in a particular direction (irrespective of sign) is greater than ten miles per second, especially as regards such stars as I have been considering.

Another mode of regarding the table suggests that the true proportion between the motions of receding and approaching stars in North Pole direction is at least 3 to 1. I mean, comparing the numbers attached to the approaching and receding stars which have approximately the same apparent proper motion. I have tried this for the receding stars numbered 30, 60, etc., on to 330, in my list, and give the numbers of the approaching stars which most nearly coincide, and also the proper motion of the approaching star whose number is one third of that considered.

No. of Receding Star.	Motion.	No. of Nearest Approaching Star.	Motion.	No. of Approaching Star, = ⅓ of Receding.	Motion.
30	1″.18	7-8	1″.15	10	0″.95
60	0 .80	16	0 .80	20	0 .76
90	0 .61	30	0 .61	30	0 .61
120	0 .50	35	0 .49	40	0 .45
150	0 .44	41	0 .44	50	0 .39
180	0 .40	48-9	0 .40	60	0 .36
210	0 .38	51-5	0 .38	70	0 .34
240	0 .35	62-6	0 .35	80	0 .30
270	0 .33	71-2	0 .33	90	0 .29
300	0 .31	77-8	0 .31	100	0 .26
330	0 .30	79-82	0 .30	110	0 .25

Here there is in every instance more than three times as many stars with a given amount of receding motion as with the same amount of approaching motion, with a single exception in which the number is exactly threefold. Towards the end of the table the number becomes nearly 4 instead of 3. Now, a ratio of 4 to 1 would imply that the Sun's motion in North Pole direction was just the average motion of the stars

resolved in that direction. But the present test is not as fair a test as the preceding one. As *real* proper motion diminishes we may expect to find an increasing number of stars at every stage. Hence, the number of stars which can be *brought down* to a particular figure by the effect of the Sun's motion will probably be always less than those that can be *raised to* it by the same effect; and if we take all the stars having a given velocity (irrespective of sign) in the direction of the North Pole of, say, 0″.30 per annum, our list will contain a larger number of raised stars than of lowered stars. I do not, therefore, see any valid reason for inferring that the Sun is moving towards the North Pole with a velocity exceeding one half of the average star-motion resolved in that direction. I hope some other member of the Society will take up the subject and arrive at more extensive and satisfactory results. I thought the method in any event worth mentioning, and, with our growing knowledge of the spectroscopic velocities of the stars, I think the prospect of being able to measure the Sun's motion in miles per second cannot be regarded as by any means hopeless.

STAR CATALOGUES.

By Elliott Smith.

The determination of the positions of the stars has long been a matter of much concern to astronomers, and star catalogues have from time to time been issued giving their position with greater or less precision, according to the skill of the observer, the accuracy of his instruments, or the purpose for which the catalogue was made. As a result we have many star catalogues at our disposal, and it may not be out of place to call the attention of A. S. P. readers to a few of these at this time.

Without going into detail it will, no doubt, be sufficient merely to mention the earlier catalogues. They are so inaccurate as to be of no practical value, and they have no connection with modern catalogues, with the exception that the names or numbers assigned to the stars in some of them are in use